EFFECT OF BRAIN BASED LEARNING MODULE ON CONCEPT FORMATION ABILITY, ACADEMIC ACHIEVEMENT AND STRESS OF STUDENTS AT MIDDLE STAGE

Synopsis

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1. INTRODUCTION

Education is a powerful weapon that aids an individual to face the adverse situations of life and overcome them. It is a systematic process that helps to gain knowledge, skills, experience and a sound attitude. It makes one refined, cultured, and civilized (Parankimalil, 2012). But the present scenario of education focuses on just imparting bookish knowledge and rote memorization to students which is not a right way to impart education.

Education in a right way helps in sound learning and holistic development of the student. Learning is nothing but net change in observable behaviour of a learner. There is an organic connection between learning and survival, because it allows the learner to adjust to a changing environment according to the need of the hour.

NCF 2023 emphasizes the need for a holistic approach to education that promotes the overall development (physical, emotional, social and cognitive skills) of students. It focuses on competency-based education which emphasize developing skills and competencies (critical thinking, creativity, conceptual ability communication and problem-solving skills) rather than mere knowledge acquisition. Children can learn in a variety of ways- through experience, making and doing things, experimentation and expressing themselves both individually and with others. They require opportunities of all these kinds in the course of their development to bring holistic and maximum development (The National Curriculum Framework, 2005). The education system has to be converted into a pleasurable learning process which is capable to generate interest in the students and motivate them to stay back in the institution rather than running away from it. Education should become a fun and thrill to the students rather than burden and boredom. It is an integral part of individual's growth and helps them to become a good citizen. It not only imparts knowledge, skills and inculcate values but it is also responsible for building human capital which breed and sets technologies innovation and economic growth.

In order to overcome the drawbacks of the conventional methods of teaching and raise the standard of instruction, new theories, methods and approaches such as constructivism, multiple intelligence, active learning, inquiry-based learning, problem-based learning and many more are now being proposed. To develop various perspectives on teaching, numerous empirical studies have been conducted and conceptual thinking has been engaged in. Brain-Based Learning is one of these perspectives. Teaching

methods, lesson designs and school programs that are based on latest scientific research about how brain learns, including factors like cognitive development. Brain based learning refers to how students learn differently as they grow and mature on a social, emotional and cognitive level.

1.1 Concept of Brain Based Learning

''I never teach my pupils. I only attempt to provide the conditions in which they learn.''

(**Albert Einstein**)

It is clear from the statement that teachers provide only conditions and circumstances to learners, because each learner's ability is different to learn. These differences are due to varying abilities of the human brain, which is a superior and complex organ that allows human to generate new ideas and concepts in unique ways. Neuro-scientists have conducted several studies to understand the human brain better, revealing its ability to perform multiple activities simultaneously and store information in different lobes of brain. When teaching strategies are based on the understanding of how brain functions, learning becomes more effective, meaningful and stress-free for learners. Jenson (2008) conducted research on Brain-Based Learning which emphasis on teaching strategies and principles that correspond to how the brain functions. Harsa (2007) claimed in his research that learning becomes more meaningful and permanent when using brain-based learning techniques. Kaur (2013) also researched the most effective teaching strategies to encourage students and help educators achieve their goals more effectively.

Brain Based Learning is a learner centred approach which is presented to assure that the learning is more effective and long lasting. It's aims to enhance various aspects of learners' learning such as knowledge retention, acquisition, academic achievement, academic performance, positive or scientific attitude, mental and emotional health, interest in learning, concept ability and reduce the stress. BBL approach identifies that which learning activities are depend on the structure, functions and cognitive process of human brain.

As a learning approach brain-based learning is different from the traditional method and its main objective is move from memorizing information to meaningful learning. Twelve Brain Based Learning Principles were developed by Renate and Geofrey Caine (1991,1994). The BBL principles guide

educators to select and prepare the learning environment in classroom. Applied to education, however, they help us to re-conceptualize teaching by taking us out of traditional frames of reference and guiding us in defining and selecting appropriate strategies. These principles and strategies are given below:

Table 1. BBL Principles and Strategies

S. No.	BBL Principles	Meaning of Principle	Teaching Strategies Which will be used during the teaching-learning process
1.	**The brain is a parallel processor**	It can perform several activities at once. Thoughts, emotions, imagination and Predispositions operate simultaneously and interact with the expansion of general social and cultural knowledge.	• Art-Integrated Learning (Visual-Art, Performing-Art) • Interdisciplinary Teaching • Project Based Learning • Collaborative Learning • Experiential Learning • Concept Mapping • Mind Mapping • Multi-Sensory Teaching
2.	**Learning engages the entire physiology**	Everything that affects our physiological functioning affects our capacity to learn.	• Activity Based Learning • Art-Integrated Learning (Visual-Art, Performing-Art) • Field Visit and Real-World Experiences • Mindfulness and Relaxation • Sensory- Integrated Learning
3.	**The search for meaning is innate**	The search for meaning is survival-oriented and basic to the human brain.	• Experiential Learning • Activity Based Learning • Visualization • Dramatization • Field Visit • Concept Mapping • Mind Mapping • Inquiry-Based Learning • Personal Relevance • Real-Life contextual Learning
4.	**The search for meaning occurs through patterning**	Patterning refers to the meaningful organization and categorization of information. The brain is designed to perceive and generate patterns, and it resists having patterns imposed.	• Graphic Organizer Teaching (Formulas, Pictorial form, Flow Chart and many more) • Thematic Teaching • Interdisciplinary Teaching • Integrated Project • Correlation between different subjects • Comparative Analysis (Text Comparison, Historical connection & relation etc.) • Gamification • Scaffold Learning (Chunking)
5.	**Emotions are critical to patterning**	What we learn is influenced by emotions and organized, but emotions are dependent on the situation, making	• Healthy & positive classroom environment (Create & maintain, safe & supportive environment in

		it extremely challenging to establish a pattern in the context of emotions.	classroom, celebrating the success, use motivational activities & many more.) • Interactive & Cooperative Learning (Group Work, Discussion, Role-Play etc.) • Emotionally Engaged Learning (Story Telling, Narrative, Relatable Examples etc.) • Meditation (Mindfulness Activities & Yoga) • Art-Integrated Learning (Visual Art, Performing Art) • Using metacognitive activities
6.	**The brain processes wholes and parts simultaneously**	There is evidence of brain laterality; however, the two hemispheres are inextricably interactive.	• Holistic and analytic teaching (close reading, breakdown of complex concept, deductive-inductive method etc.) • Graphic Organizer teaching • Project based learning (Integrated projects, real world problems, cooperative learning) • Team Teaching (Group Teaching, Peer Teaching) • Reflective Practices • Concept Mapping • Mind Mapping • Field Visit • Exhibitions
7.	**Learning involves both focused attention and peripheral perception**	The brain absorbs information of which it is directly aware, but it also incorporates the one that lie beyond the field of attention.	• Experiential Learning • Technology Integrated Teaching (Educational App, Interactive White Board etc.) • Activity Based Learning • Art integrated Learning • Concept Mapping • Mind Mapping
8.	**Learning involves both conscious and unconscious processes**	Signals that are peripherally perceived enter the brain without the learners' awareness and interact at unconscious levels.	• Experiential learning • Naturalistic Learning (Real Life Context) • Repetition/Practice Based Learning (Space Repetition, Skill Drills, Project Based Learning) • Multisensory Learning • Gamification • Activity based learning • Cooperative & collaborative learning • Art Integrated Teaching • Graphic Organizer Teaching

9.	**We have two types of memory: spatial and rote**	The spatial memory system does not need rehearsal and allows for instant memory of experiences. The counterpart of the spatial memory system is a set of systems designed for storing relatively unrelated information (rote).	• Experiential learning
			• Activity based learning
			• Graphic Organizer Teaching (Mind Map, Concept Map, Flow Chart, Pictorial Diagram etc.)
			• Gamification
			  • Art Integrated Learning
			  • Scaffolded Learning
			  • Cooperative & collaborative learning-
			• Concept Mapping & Mind Mapping

10.	**We understand and remember best when facts and skills are embedded in natural, spatial memory**	Spatial memory is generally best invoked through experiential learning.	• Experiential Learning • Field Based Learning (Outdoor Education, Community Based Learning) • Real-life Contextual Learning • Cooperative & collaborative learning • Concept Mapping & Mind Mapping • Repetition Based Learning
11.	**Learning is enhanced by challenge and inhibited by threat**	The brain downshifts under perceived threat and learns optimally when appropriately challenged.	• Connect topic/content with real natural environment & daily life • Experiential Learning • Cooperative learning • Gamification
12.	**Each brain is unique**	We all have the same set of systems, but they are integrated differently in every brain.	• Connect topic/content with real natural environment & daily life • Individualized Learning • Experiential Learning • Challenges Based learning (CBL) • Art Integrated Learning • Activity Based Learning

Above-mentioned these principles demonstrate how the teaching-learning process can incorporate brain-based learning. On the basis of BBL principles, these strategies are helped to educators for effective teaching learning process. Applying these during social science teaching, a teacher can create positive and cooperative environment in classroom. All these strategies according to BBL principles make the content easy, understandable, developing concept ability of the students. These are making the students actively engaged in learning and also motivate them to learn.

1.2 Concept Formation Ability:

The term Concept was introduced by **Jean Piaget** in his theory of Cognitive Development. A concept is a generalised idea about a class of objects, attributes, occurrences or process that has been given a name. According to **Morgan**, ‘‘Concept is the process of representing the common property of objects

or event.''

Concept formation refers to the process of acquiring new concepts or mental representation of objects, events or relationships. This term was introduced by Jean Piaget in his theory of cognitive development. It involves comparative thinking, symbolic interaction and logical reasoning. It is great way for students to understand the concept of something new. The term concept formation, or concept learning is used by Psychologists to refer the development of the ability to respond to common features of categories of objects or events. Bourne & colleagues (1986) said that in learning a concept, one must focus on the relevant features and ignore those that are irrelevant. Concept provides an efficient way of organizing experiences.

It refers to an individual's capacity to understand, organise, and categorise information to develop coherent and meaningful concepts. It involves the mental processes through which a person identifies common characteristics, discerns patterns, and creates mental representations that encapsulate a group of related objects, events, or ideas. Concept formation is the process whereby information is formed into concepts, which includes four stages:

1. Observation
2. Categorisation
3. Abstraction
4. Generalisation

1. Observations: This is the first stage of Concept formation, which is based on the observation of an event/object or an experience. It can also be called the stage of becoming aware. This awareness can be direct or indirect.

2. Categorisation: It is a critical cognitive process that involves the process of organizing the objects, ideas, or information into groups based on common features. After observation learners categorize and differentiate the different concepts and able to define each category. It is crucial for understanding the boundaries of various concepts.

3. Abstraction: This is third stage of concept formation ability which involves identifying core features, ignoring non-essential details and forming general concepts. After categorization they become able to transform comparable and contrasting experiences into concepts. This cognitive process

increases cognitive capabilities, problem solving, transfer of learning and communication skills.

4. Generalisation: Generalization refers to apply a learned concept or principle to new situations. This is a final stage for constructing a new concept. In this stage the learner generalized the final term of the new concept of continuity of previous stages. After making such observation in the form of abstraction for a number of times the child is able to generalize or form a general idea about the common properties of some objects or events. On account of this generalization, the learner will develop a concept about things or events.

Academic Achievement:

Academic achievement describes academic outcomes that indicates the extent by which a learner, instructor, or school achieved its teaching-learning objectives such as critical thinking, problem solving ability, conceptualization, Higher order thinking skills, positive attitude, positive thinking, observation skill, creativity, etc. It represents the knowledge, abilities, and competences that individuals have attained in a learning environment and frequently assessed through standardized tests, grades, and other assessments.

In the social science domain, academic achievement denotes the extent by which learners have effectively acquired knowledge, abilities, and proficiencies regarding various sub subjects of social sciences for example– geography, history, sociology, political science, economics, and anthropology are all included in this.

1.4 Stress:

Stress refers to the body's physiological and psychological response to demands or pressures placed on it. It is a natural reaction that helps individuals adapt and cope with challenging or threatening situations. Stress can arise from various sources, including work, relationships, financial concerns, health issues, major life changes, and many more. Stress may be generated from internal or external condition of a person.

Stress during learning for learners refers to the strain or tension experienced by individuals while acquiring & retaining knowledge, performance, various learning activities, during exams and many more. This stress can manifest in various ways and may be influenced by factors such as academic pressure, expectations from performance, learning environment, individual characteristics, parental

aspirations and many more.

It can be viewed as a personal reaction to an external event like; exams, interact with society (teachers, Peer group, Principal and other), answering the questions in various situations, concentrating during session/ learning, presenting our views, not completing the assigned work such as; DHAs/ assignments or projects on time and many more and the internal state of mind in different situation like; worrying about an exam, frequently mood swings a few days before the exam, decision making, problem solving, ignorance, acceptance in society etc. stress may be affect positively or negatively on learners' personality.

Dimensions of Stress:

Physical dimensions: The physical dimensions of stress refer to the physiological responses and effects on the body. Such as: the heart rate and blood pressure typically increase, muscle contraction, it can contribute to discomfort and pain in the neck, shoulders, and back, contribute to headaches or migraines., influence breathing patterns (shallow or rapid breathing), digestive system can be impacted, resulting in symptoms like stomach ache, indigestion, or changes in appetite, difficulty in sleeping and many more.

Mental dimensions: These dimensions manifest the impact of stress on cognitive processes, mental well-being. Such as: Anxiety, Frustration, Irritability, Difficulty Concentrating, clarity of thoughts, organisation, Memory Issues, Mood Swings, lack of Self-Esteem and Confidence.

Behavioural dimensions: The behavioural dimensions of stress refer to observable changes in behaviour that occur in response to stressful situations or stimuli. These changes in behaviour may manifest in various ways, reflecting the individual's attempts to cope with or adapt to the perceived stressors. Behavioural responses to stress can vary widely among individuals and may be influenced by factors such as personality, coping strategies, and environmental factors.

Emotional/Affective dimensions: The affective dimensions of stress refer to the emotional or subjective experiences associated with stress reactions. Stress can elicit a wide range of emotions, which can vary in intensity, duration, and impact on individuals' well-being. The affective dimensions of stress encompass the emotional responses and psychological states that individuals may experience in reaction to stressful situations or stimuli.

Academic Dimensions: The academic dimensions of stress refer to the psychological distress associated

with educational demands and expectations. It can arise from various factors related to the academic environment and can impact students' mental and physical health, as well as their academic performance. The key sources of academic stress are; high academic expectations, workload, time management, test anxiety, lack of sleep, social pressures, uncertainty about the future etc.

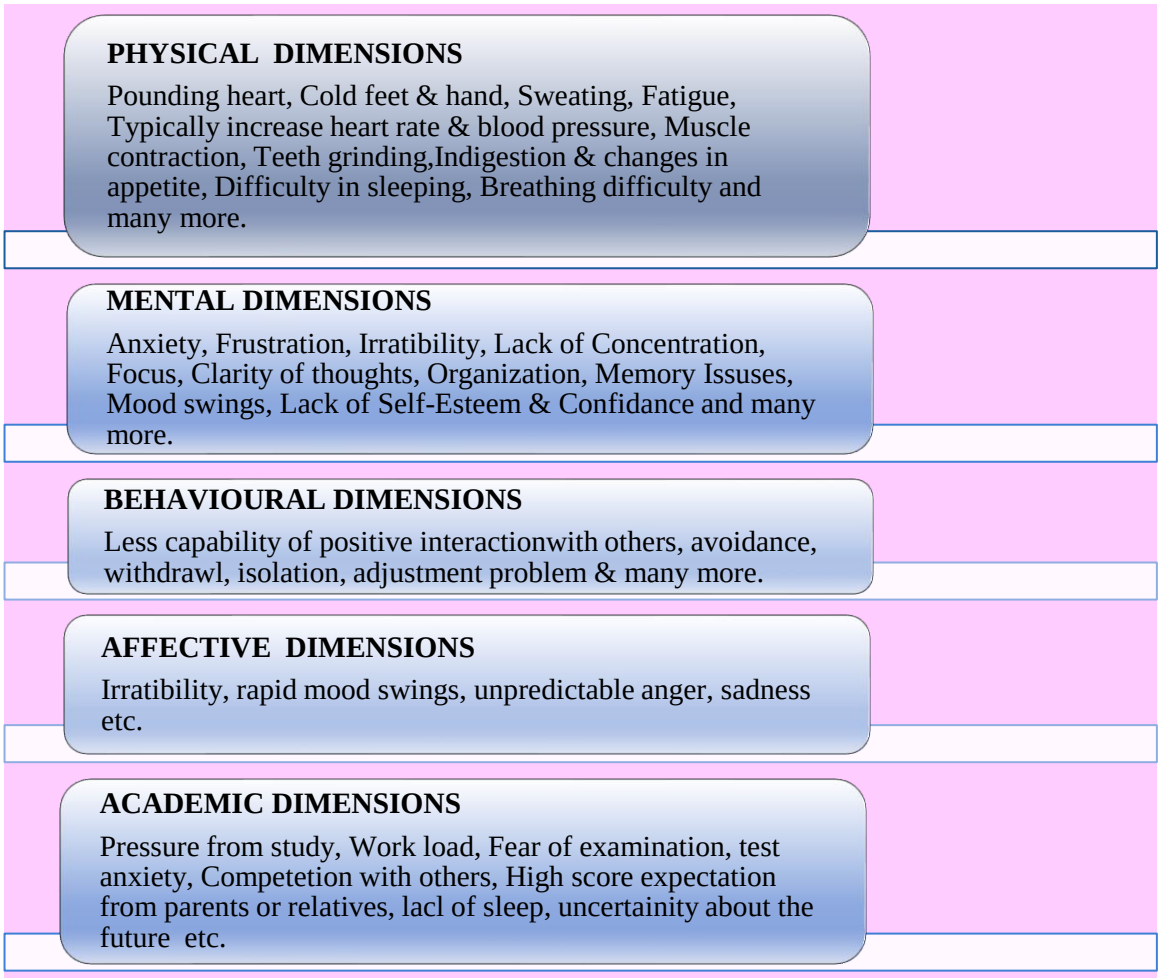
PHYSICAL DIMENSIONS
Pounding heart, Cold feet & hand, Sweating, Fatigue, Typically increase heart rate & blood pressure, Muscle contraction, Teeth grinding,Indigestion & changes in appetite, Difficulty in sleeping, Breathing difficulty and many more.
MENTAL DIMENSIONS
Anxiety, Frustration, Irratibility, Lack of Concentration, Focus, Clarity of thoughts, Organization, Memory Issuses, Mood swings, Lack of Self-Esteem & Confidance and many more.
BEHAVIOURAL DIMENSIONS
Less capability of positive interactionwith others, avoidance, withdrawl, isolation, adjustment problem & many more.
AFFECTIVE DIMENSIONS
Irratibility, rapid mood swings, unpredictable anger, sadness etc.
ACADEMIC DIMENSIONS
Pressure from study, Work load, Fear of examination, test anxiety, Competetion with others, High score expectation from parents or relatives, lacl of sleep, uncertainity about the future etc.

Figure 1. Dimensions of Stress

2. EMERGENCE AND JUSTIFICATION OF THE STUDY

Brain-Based Learning is a learner-cantered and teacher-facilitated approach that utilizes learners' cognitive endowments. This approach is based on the structure and functions of the brain in different aspects such as learning, assimilating, thinking and remembering. Lucas [2004] asserted that as long as the brain is not prohibited from fulfilling its normal processes, learning will occur since everyone is born with a brain that functions as an immensely powerful processor. Understanding how the brain learns and relating it to the educational field resulted in the concept known as brain-based learning. Brain-Based Learning is defined as any teaching approach that utilizes information about the human

brain to organize how lessons are constructed and facilitated with emphasis placed on how the brain learns naturally. It is an effective approach for developing creative solutions to problems. It is an open sharing activity which encourages all students to participate in teaching learning process. The advantage of this approach is by expressing ideas and listening to what others say: students can adjust their previous knowledge, and accommodate new information and increase their levels of awareness. Sousa [2004] stated that a brain-based approach integrates the engagement of emotions, nutrition, enriched environments, music, movement, meaning making and the absence of threat for maximum learner participation and achievement.

Brain-Based Learning (BBL) involves accepting the rules of how the brain processes, and then organizing instruction bearing these rules in mind to achieve meaningful learning. BBL is a way of thinking about the learning process. It is a set of principles and a base of knowledge and skills through which we can make better decisions about the learning process. Kolb and Kolb [2005] opined meaningful learning does not occur in a single way, but in a unity of circulation because the brain works in a unity while learning. Duman, [2010] opined that teaching should start with the exploration of the brain. Based on the findings of neuroscience. BBL guides according to the principles and workings of the brain to improve the best way of learning, increase academic achievement, and provide equal opportunities for individual differences. According to Jensen [2008], Brain-Based Learning was related to teaching strategies and principles from an understanding of how the brain functions and learning with the brain in mind.

Another research on Brain Based Learning theory was that of Jensen [2008] that drew from multiple disciplines such as Chemistry, Biology, Genetics and Neurology. Brain-Based Education considered how the brain learns best and encouraged educators to take this information into consideration as they planned teaching strategies with the goal of more effectively motivating all types of learners and enhancing positive attitudes in classroom.

Researcher reviewed various studies based on brain-based learning at national and international level. These studies are as fellow:

Table 2. Researches related Brain Based Learning

S. No.	Name of Researchers	Research Topics	Findings
1.	Agarwal, Shweta (2023)	Effect of Brain Based Learning Strategies on Educational Aspiration of Students at Upper Primary Level	The finding of the study reveals that use of BBL strategies in teaching learning activities has a positive & significant impact on the educational aspiration of students at the upper primary level
2.	Abiodun Bada & Loyiso Jital (2022)	Effect of Brain-Based Teaching Method on Secondary School Physics Students' Retention and Self-Efficacy	Based on the finding from this research, the researcher concludes that BBT method improved students' retention ability in the concepts learnt better than the students taught using the conventional lecture method irrespective of the differences in the characteristics of the students. This study also revealed that physics students' self-efficacy did not significantly influence students' ability to retain the concept learnt. The use of BBT method is not biased along physics students' self-efficacy.
3.	Vasilia Christidou & Denis Vavougios (2022)	Effectiveness of a Teaching Approach Using Brain Based Learning Elements on Students' Performance in a Biology Course	The result revealed that the students of experimental group had a significantly higher mean score than the students of the control group on an achievement test which was delivered as post-test, indicating that the suggested teaching approach had a positive effect on students' improvement in academic performance.
4.	Amjad Islam & Musarrat Habib (2022)	Effect of Brain-Based Learning on Students' Mathematics Performance at Elementary Level	The study found that the BBL strategies has positive impact on mathematics performance of students at elementary level.
5.	Jack Gladys Uzezi and Kyado Joel Jonah (2017)	Effectiveness of Brain Based Learning Strategies on Students' Academic Achievement, Attitude, Motivation and Knowledge Retention in Electrochemistry	The finding of the study imply that Brain Based Learning has much more positive effect on students' academic achievement, attitude, motivation and knowledge retention in Electrochemistry compare to lecture-based teaching.
6.	Hafiza Gulnaz Fatima (2020)	Applying Brain Based Learning Modules for Learning Acceleration of 6^{th} Grade Science Student	Applying Brain Based Learning Modules for Learning Acceleration of 6^{th} Grade Science Student
7.	Thangam, Asha (2019)	Brain Based Digital Learning Technologies and Achievement in Social Science	Its findings revealed that BBL Technologies have significant effect on students' interest, memory, concentration, learning style and success for good achievement in social science subject. Along with BBL developed the ability such as; group discussion, attention, creative thinking among learners for future aspects.

8.	Saleh, S., & Subramaniam, L. (2019).	Effects of brain-based teaching method on physics achievement among ordinary school students.	The aim of this study was to measure the effectiveness of the BBTA (brain-based teaching approach) in dealing with issues related to the learning motivation towards the subject of physics amongst secondary school students in Malaysia. The findings of this study showed that the BBTA module was an effective teaching approach in dealing with the issue aforementioned. It was found that students who followed the BBTA module possessed a better physics learning motivation compared to students who received CTM (conventional teaching method).
9.	Mustafa Eroll, Gulash Batdal Karaduman (2018)	The Effect of Activities Congruent with Brain Based Learning Model on Students' Mathematical Achievement	The purpose of the study was to investigate the effect of teaching activities prepared with brain-based learning model on mathematic success of primary school students. The findings of this research a significant difference has been found in favour of experimental group regarding the mathematics achievement of the 4th grade students and persistence of knowledge they have learned.
10.	Virginia Bonomo (2017)	Brain-Based Learning Theory	The purpose of this study is to examine whether there is a correlation between gender-specific literacy instruction and the reading achievement of boys in single-gender schools. The results shows that there is a gap in the literature regarding the impact of single-gender education and the reading achievement of boys.
11.	Noureen, G., Awan, R.N., & et al. (2017).	Effect of brain-based learning on academic achievement of VII graders in mathematics.	Researcher have focussed on finding the effect of BBL strategy on mathematics class 7th students' achievement. Its result revealed that, there was positive effect of brain-based learning strategies on students' achievement, develop positive attitude towards mathematics.
12.	Varghese, M.G. and Pandya, S. (2016)	Effectiveness of Brain-Based- Learning on academic achievement, study habits and stress of students at the secondary level	This study focused on effectiveness of brain-based learning on academic achievement, study habits and stress of students at the secondary level. The researcher recommends the exhaustive application of this approach for effective classroom transactions and advocates the academicians and educators to publicize it ross the globe for the benefit of the learner community.
13.	Vyas, Karnika (2016)	Brain Based Learning as a determinant of Academic Stress, Test-Anxiety and Academic Performance in struggler learners	The finding of the study reveals that BBL has significant effect on academic performance of struggler learner and helpful to reduce the stress during the exams.
14.	Jayalakshmi Ramakrishnan (2015)	Effectiveness of Brain-Based- Learning Strategies for	The purpose of the study was to effectiveness of brain-based learning strategies for enhancing creativity among 9th standard Pupils. The finding

		Enhancing Creativity among 9th Standard Pupils	of the study revealed that BBL Strategies is more effective in experimental group.
15.	Sharma, Anita (2013)	Effect of Brain Based Instructional Strategies on Achievement and Self-Esteem of Science Students in Relation to Their Learning Style	The study concluded that Instructional Strategies based on Brain Based Learning has positive effect on achievement and self-esteem of science students. It is helpful to increase self-esteem and to improve their academic scores.
16.	Akyurek, E., & Afacan, O. (2013)	Effect of Brain-Based Learning Approaches on Motivation and Attitudes towards class 8th science students	The purpose of the study was to examine the effect of brain-based learning approach on attitudes and motivation levels in 8th grade students' science classes. As a result, Brain-based learning approach used in the experimental group's achievement test scores of control group's achievement was determined to be statistically significant difference in favour of the experimental group.
17.	Tufekci Serap and Demirel Melek (2009).	The Effect of Brain Based Learning on Achievement, Retention, Attitude and Learning Process	Its result revealed that, there was positive effect of brain-based learning strategies on students' achievement, retention, develop positive attitude regarding subject.
18.	Cengelci, T. (2007)	The Effect of Brain Based Learning to Success and Retention in Social Studies	The finding of this study indicate BBL Approach has a positive impact on academic success and retention and the learners seemed to have positive perspective on BBL. Students' responses showed that this approach provides memorable and enjoyable learning experiences without a need for memorizing the content.
19.	Duman, B. (2006).	The effect of brain-based instruction to improve on students' academic achievement in social studies	The finding of this study revealed that the brain-based learning approach used in the experimental group was more effective increasing students' achievement than the traditional approach used in the control group.

After reviewing literature, the researcher has found that several studies have been conducted on brain-based learning with other variables such as; retention, motivation, academic performance, attitude, academic success, reading outcomes, learning style, life-skills, self-esteem, self-efficacy, study-habit, learning acceleration, mental-stress, text anxiety etc. at various educational levels in different subjects at national or international level. Furthermore, the researcher has observed that, comparatively to science and mathematics subjects, few studies have been conducted in social science subject with brain-based learning. On the basis of findings of previously mentioned researches it can be concluded that BBL has a positive impact on almost all dependent variables in various subjects and makes the learning environment more enjoyable and memorable in comparison to the traditional classroom. In the continuation, the researcher has also observed that concept formation ability and stress have not been

studied in relation to BBL approach. Therefore, for filling this gap the researcher has decided to conduct the research aimed to investigate the effectiveness of brain-based learning module of social science on concept formation ability, academic achievement and stress of students at middle stage.

Above analysis of previously mentioned researches and its findings, the following questions about Brain Based Learning in the field of social science have emerged in researcher's mind:

1. Will Brain Based Learning Module help to educators for enhance quality of teaching-learning process for social science?
2. How will a Brain Based Learning module be effective to enhance the concept formation ability of students at middle stage?
3. How will a Brain Based Learning module be effective to enhance academic achievement in term of social science?
4. How will a Brain Based Learning module be effective to reduce stress at middle stage students?
5. Will module be helpful to discourage the stressful learning environment and support to create the relaxed and stress-frees learning classroom?

It is expected that the answers of this study's research questions will increase concept formation ability, academic achievement and reduce stress of learners. It may be helpful to teachers, learners, management of schools or colleges, pupil teachers, teacher educators, policymakers and parents regarding above aspects. In addition, brain-based learning module will help to enable the learners to develop the concept formation ability and maintain their mental-emotional stability which is essential for their academic success. Thus, the researcher has decided to carry out this research work in order to make social science learning interesting as well as facilitate.

3. STATEMENT OF THE PROBLEM

To find out the answers to above mention research questions, the following problem can be selected below:

Effect of Brain Based Learning Module on Concept Formation Ability, Academic Achievement and Stress of students at middle stage.

4. DEFINITIONS OF KEY TERMS

4.1 Brain Based Learning: Brain Based Learning is simply the engagement of strategies based on BBL

principles. It is a multidisciplinary approach built on the fundamental question; ―what is good for the brain? It is also called as brain compatible learning.

According to **Caine & Caine (2002), ‘‘**Brain based Learning is also the application of a meaningful group of principles that represent our understanding of how our brain works in the context of education.”

According to **Leslie Hart (1983), ‘‘Brain** Based Learning is dynamic interdisciplinary system-wide approach based on the way current research in neuroscience suggests our brain naturally learn best.**”**

Operational definition: In the present research, brain-based learning is defined as a cognitive approach in which different types of physical and mental strategies based on BBL principles are included. These principles are developed based on the functioning of the human brain. This approach will support learners to learn through a natural developmental process and is also helpful for teachers to select appropriate strategies during their teaching according to learners' needs.

4.2 Module: The term module refers to an educational unit that focuses on a particular topic of a subject. It's a path way for teaching-learning activities. Although the details and activities vary according to the specific context such as subjects, topics, need in the society, student level and many more. It includes information about the topic, focus on student-centred learning activities. A learning module is an organized collection of content for effective teaching-learning. It supports to planning of teaching, teaching-learning activities and Evaluation techniques.

“A module is a set of learning opportunity organized around a well-defined topic which contains the elements of instructions, specific objectives, teaching learning activities and evaluation using criterion referenced measures". (**UNESCO, 1988**)

Operational definition: In the present study, module refers to teaching-learning sets for intervention on various topics for social science teaching based on BBL principles for effective teaching and learning so that teachers and learners may be able to deal with challenging circumstances during social science teaching-learning activities at middle stage students.

4.3 Concept Formation Ability: Concept formation refers to a high-order mental process that acts on information which have been perceived through our sensory organs and encoded or stored in memory.

According to **Woodworth, ‘‘**Concepts are ideas which refers to objects, events, qualities etc."

According to **Piaget,** ‘‘Concept formation refers to the process of acquiring new concepts or mental representation of objects, events or relationship.’’

Operational definition: In the present research, concept formation ability is defined as a mental process, whereby information is formed through four stages observation, Categorization, abstraction and generalization in the context of social sciences.

4.4 Academic Achievement: Academic outcomes\results that show the level of a learner’s learning goals/achievement are referred to as academic achievement.

According to **Good (1974), ‘‘**The Academic Achievement refers to performance in school in standardized series of educational test.”

Operational definition: In the present study, academic achievement refers to the performance of learners in social science achievement test as indicated by learners’ obtained score.

4.5 Stress: According to **Robbins (2001), ‘‘**Stress is a dynamic condition in which the individual is confronted with an opportunity, constraint or demand related to what he or she desires and for which the outcome is perceived to be both uncertain and important.**”**

Operational definition: In the present study, Stress refers to the physical (Physical Stress often manifests physically through symptoms such as muscle tension, headaches, fatigue, gastrointestinal issues, and changes in appetite or sleep patterns etc.), mental (It often affect cognitive functioning, including concentration, memory, and decision-making abilities and many more), emotional (It influence mood, behaviour, feelings and interpersonal relationships), behavioural (It manifests behaviourally in various ways, such as avoidance behaviours, aggression, withdrawal, procrastination, or increased substance use, isolation etc.) and academic stress (It refers the high academic expectations, workload, time management, test anxiety, lack of sleep, social pressures, uncertainty about the future etc)of learners.

4.6 Middle Stage: According to **NEP2020, ‘‘**Middle stage for three years. This stage includes the classes from 6^{th} to 8^{th} and the students between the ages of 11 to 14.”

Operational definition: In the present research, Middle Stage refers to the students who are studying in class 8^{th}.

5. OBJECTIVES OF THE STUDY

1. To develop the Module based on Brain Based Learning's teaching Strategies for Social Science subject at middle stage students.
2. To study the effect of Brain Based Learning Module on Concept Formation ability of Middle Stage students.
3. To study the effect of Brain Based Learning Module on Academic Achievement of Middle Stage students.
4. To study the effect of Brain Based Learning Module on Stress of Middle Stage students.

6. HYPOTHESIS OF THE STUDY

Ha1: There will be a significant effect of Brain Based Learning Module on Concept Formation ability of Middle Stage students.

Ha2: There will be a significant effect of Brain Based Learning Module on Academic Achievement of Middle Stage students.

Ha3: There will be a significant effect of Brain Based Learning Module on Stress of Middle Stage students.

7. DELIMITATION OF THE STUDY

The present research will be conducted under the following delimitations-

1. The study will be delimited to Agra city only.
2. The study will be delimited to middle stage of DEI board
3. The study will be conducted on 8^{th} class students only.
4. Modules will be developed for Social Science subject only.

8. VARIABLES OF THE STUDY

8.1 Independent Variable

- Brain Based Learning Module

8.2 Dependent Variables

- Concept Formation Ability
- Academic Achievement
- Stress

8.3 Controlled Variables

- Age
- Gender
- Class
- Subject
- School Board

9. RESEARCH METHOD & DESIGN OF THE STUDY

To achieve the objectives of the present study, Quasi-Experimental Research Method will be used and the two group Non-Equivalent Pre-test & Post-test design will be used. The following figure gives a brief overview of the study's research design:

Table 3. Pre & Post Non-Equivalent Group Testing & Intervention Plan

<table>
<tr><th>Groups</th><th>Pre-test Phase</th><th colspan="2">Implementation Phase</th><th>Post-test Phase</th></tr>
<tr><td rowspan="2">Experimental Group (Intact Group) N=50</td><td rowspan="3">Pre-testing of concept-formation ability, academic achievement test & stress</td><td>Treatment</td><td>Duration of Intervention Program</td><td rowspan="3">Post-testing of concept formation ability, academic achievement & stress</td></tr>
<tr><td>Class 8th will be taught by using Modules based on BBL principles & strategies to Social Science students</td><td>30 working days & 45 minutes daily</td></tr>
<tr><td>Control Group (Intact Group) N=50</td><td>Class 8th will be taught by using traditional method to Social Science students</td><td>30 working days & 45 minutes daily</td></tr>
</table>

10. PROCEDURE OF THE STUDY

The procedure of the study consists of the following phases:

1. Developmental Phase: In this phase, Social Science (Resource & Development and Social & Political Life) Module based on BBL will be developed by the researcher in the guidance of supervisor and subject experts, which can increase the ability of concept formation, improve academic achievement and reduce the stress.

2. Experimental Phase: In this phase, the experimentation process will be completed by the researcher through the selection of the intact group sample and self-constructed tools. First of all, pre-test will be administered on both groups in which concept formation, academic achievement and stress will be

tested. Then the experimental group will be taught by using the Module based on BBL principles and strategies and the control group will be taught by using traditional method of teaching. At last, post-test will be administered on both groups in which again concept formation, academic achievement and stress will be tested.

3. Evaluation phase: In this phase, scores from the post-test will be compared to one another using an appropriate statistical technique to evaluate the effectiveness of Brain Based Learning Module. The following figure gives a brief overview of the research procedure:

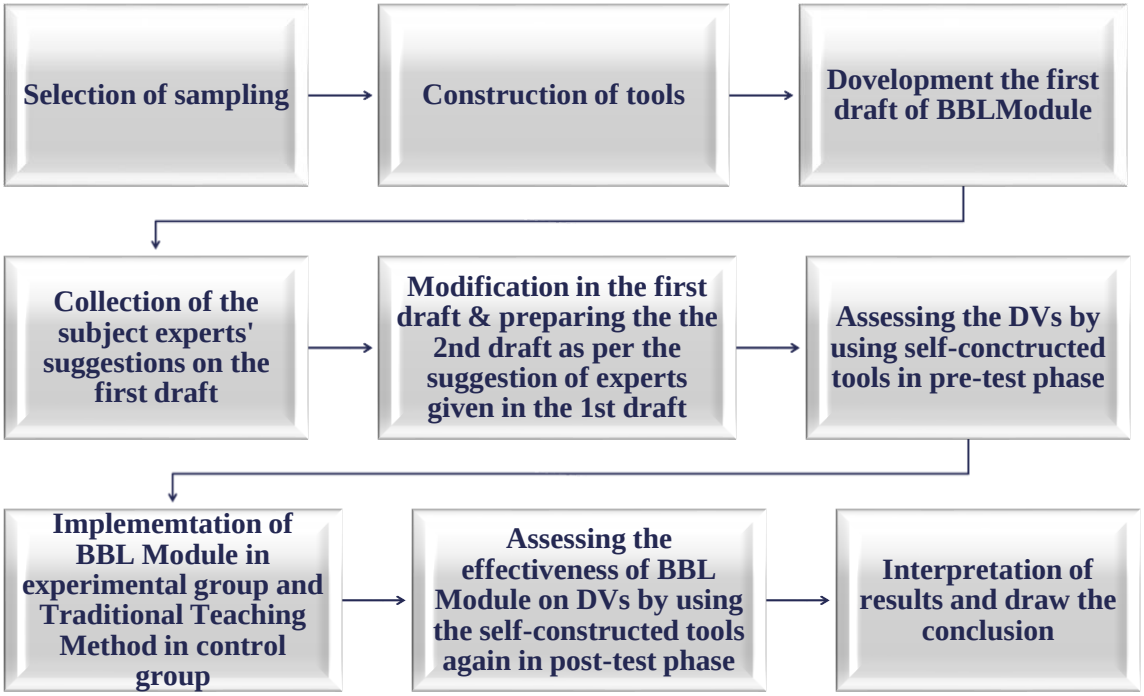
Selection of sampling
Construction of tools
Dovelopment the first draft of BBLModule
Collection of the subject experts' suggestions on the first draft
Modification in the first draft & preparing the the 2nd draft as per the suggestion of experts given in the 1st draft
Assessing the DVs by using self-conctructed tools in pre-test phase
Implememtation of BBL Module in experimental group and Traditional Teaching Method in control group
Assessing the effectiveness of BBL Module on DVs by using the self-constructed tools again in post-test phase
Interpretation of results and draw the conclusion

Figure 2. Steps of Research Process

11. DEVELOPMENTAL STEPS OF MODULE

The steps of the Social Science Module are shown in the following figure which will start with the content analysis of class 8th Social Science text-book and end with completing of the program.

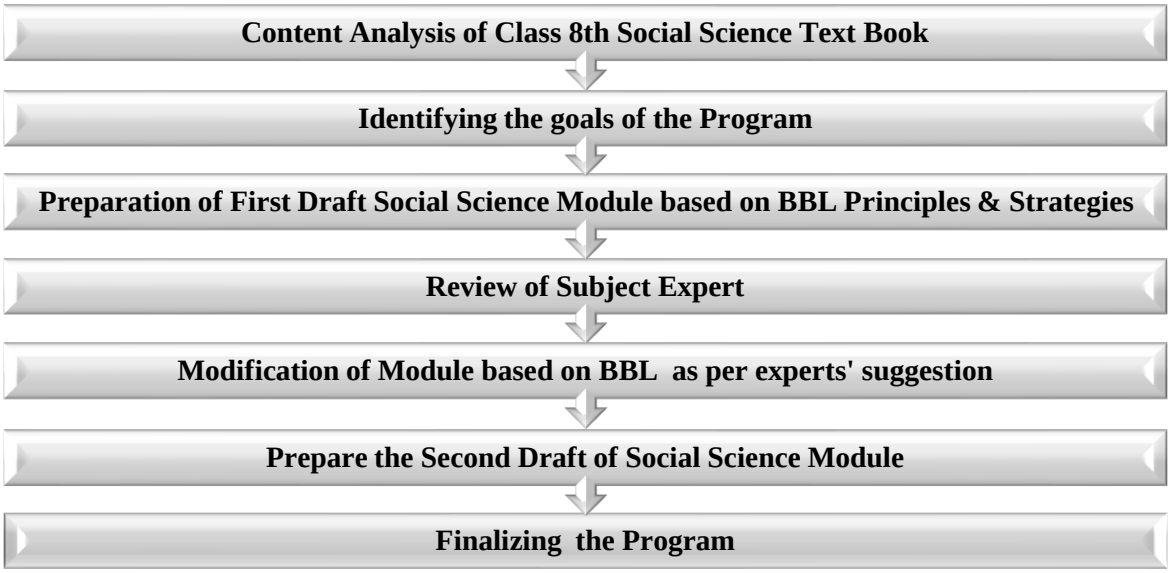
Content Analysis of Class 8th Social Science Text Book
Identifying the goals of the Program
Preparation of First Draft Social Science Module based on BBL Principles & Strategies
Review of Subject Expert
Modification of Module based on BBL as per experts' suggestion
Prepare the Second Draft of Social Science Module
Finalizing the Program

Figure 3. Steps of module

11.1 DRAFT OF LEARNING MODULE

SOCIAL SCIENCE LEARNING MODULE

Parts of simplified Module

1. Standard/class: 8th

2. Content of the module

3. General Objectives:

-
-
-

4. Strategies for teaching:

5. Evaluation Techniques: (question-answer technique, debate, quizzes etc.)

UNIT- 1

Parts of specific Learning Module

Name of unit:

Class:

Approx period:

1. About the Module:

2. Learning Outcomes: (related to unit)

-
-
-

3**. Content Presentation:**

3.1. Teaching Topic 1.:

3.1.1 Presentation: (by using suitable BBL principles & strategies)

3.1.2. Formative Assessment: (based on factual understanding, using quizzes, objectives types question & short answer)

3.1.3. Doubt Clearing Session & Guidance:

3.1.4. Generalization:

3.1.5. Summative Assessment: (based on Debate, essay type questions for developing concept formation ability)

3.1.6. Feedback:

1. I learn that
2. I realize that

3.2 Teaching Topic 2.:

3.2.1

3.3 Teaching Topic3.:

3.3.1

4. Unit Assessment regarding learning outcomes (Assignments, Activities, Unit Test etc**)**

12. SAMPLE OF THE STUDY

The population of the present research is the Middle Stage students. The purposive sampling method of non-probable sample will be used for the selection of school. In this way any one school of Agra city, will be selected for the study. After the selection of school, students of class 8th will be selected by using the intact sampling method of non-probable sample. The researcher will be selected the students of class 8th into two groups: the experimental group and the control group for research. 50-50 students will be

included in both sections. In this way total of 100 students will be selected as the sample of the study. The complete details have been given in the following figure:

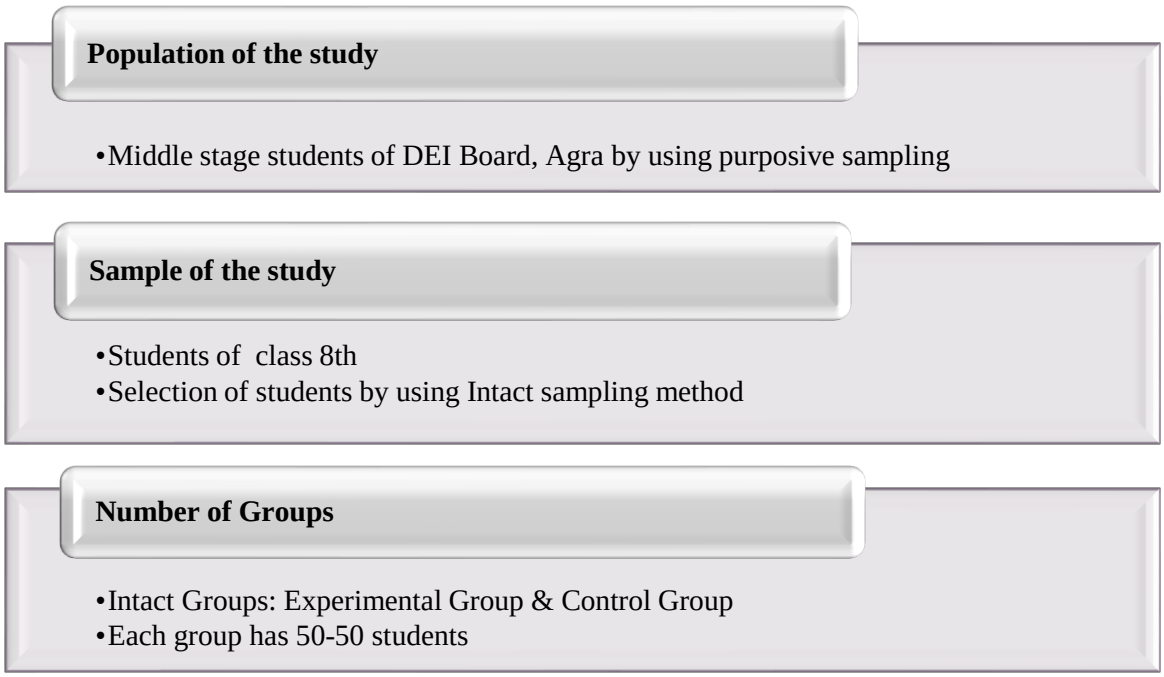
Population of the study
•Middle stage students of DEI Board, Agra by using purposive sampling
Sample of the study
•Students of class 8th
•Selection of students by using Intact sampling method
Number of Groups
•Intact Groups: Experimental Group & Control Group
•Each group has 50-50 students

Figure 4. Sample of the study

13. RESEARCH TOOLS OF THE STUDY

The researcher in this present research will construct the following tools in order to collect relevant data for the accomplishment of the suggested objectives.

13.1 Brain Based Learning Module: The module will be developed for Middle Stage students to teach Social Science based on Brain Based Learning strategies. These modules will be administrated on the experimental group.

13.2 Concept Formation Ability Tool: For the evaluation of concept formation ability, the researcher will be developed a self-constructed tool.

13.3 Academic Achievement Test: In order to assess the academic achievement of social science students in class 8^{th} self-constructed achievement test will be used with the pre and post version separately.

13.4 Stress Scale: A number of tool are available to assess the stress such as; Anxiety, Depression & stress scale: Pallavi Bhatnagar (2023).; Students Stress Scale: Akhtar (2023).; Stress Scale: Vijay Lakshmi & Shruti Narain (2020).; Academic Stress Scale: Sudip Ghoshal & Debasri Banarje (2018).;

Bist Battery of Stress Scale: Abha Rani Bist (2017).; Stress Scale: Vijay Lakshmi & Shruti Narain (2020). But these are failed to fulfil the essential criteria for the present study. Therefore, stress will be assessed by using self-constructed tool. The domains will be considered for constructing tool; physical, mental, behavioural, affective & academic.

14. STATISTICAL TECHNIQUES

The effect of brain-based learning module on middle stage students' concept formation, academic achievement and stress will be evaluated by using the following statistical techniques:

14.1 Descriptive Statistics:

- Mean
- Standard Deviation

14.2 Inferential Statistics:

- ANCOVA (Analysis of Co-Variance)

14.3 Graphical Presentation of Data: Pie Charts, diagrams etc. will be used for presenting the data and results in visual form.

15. SIGNIFICANCE OF THE STUDY

The study will be beneficial to students, educators, principals, administrators, policy-makers, parents and society as a whole. Its results will be useful in the following ways:

15.1 For students-

- Brain based learning is a learner-centred approach which is based on various theories, principles and techniques. Their learning will be more exciting or engaging if social science concepts are developed using BBL strategies.
- Brain based learning will give freedom to learners to express their doubts, opinions, and discussion with peers. So, they can learn in a secure environment.
- Additionally, it will help learners perform better and develop a more positive attitude toward social science.
- The present study will be helpful to increase learners' concentration, retention and develop concepts regarding social science.
- this research will also pave the path of learners to develop the understanding of facts instead of

cramming

- This study will help to reduce the stress and provide stress-free learning environment to learn naturally.

15.2 For educators-

- The BBL approach provides the educators the medium by which they can apply the BBL strategies in social science teaching and can facilitate interesting learning environment for their learners.
- This study will helpful to understand the thinking ability of learners and making the content interesting according to learners in classroom and then communicating it effectively.

15.3 For administrators-

- Administrators of the educational institute have a responsibility of shaping the future of their learners as well as teachers. They can motivate their teachers for applying BBL strategies according to learners' need during teaching-learning process.
- They can make the extracurricular activities more fruitful by applying BBL Reference

15.4 For text-book writers and policy-maker-

- This research will be helpful for writers to organize the content of text-books by focussing BBL approaches.
- A text-book which are written on the basis of BBL principles and strategies will be effective in term of the presentation of the content, enhance the group discussion and activities and collaborative learning.
- Through numerous workshops, seminars, conferences and other training programs, the policy-maker will make sure educators at all level of education are informed about the theories, principles and strategies of brain-based learning.

15.5 For the parents-

- This research will be helpful for parents to develop the positive attitude towards social science.
- In the reference of social science, the study will also helpful to give suitable guidance so that, they will be able to develop the concept formation, reduce stress and provide the positive environment at home regarding subject.

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